APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/966,419	09/27/2001	Patrick Vandenameele-Lepla	020798-002000US	6376

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TOWNSEND AND TOWNSEND AND CREW, LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

EXAMINER
CHO, HONG SOL

ART UNIT	PAPER NUMBER
2662	

DATE MAILED: 09/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *11,12,17-24 and 26-30* is/are allowed.

6)☒ Claim(s) *1-5,7,9,10 and 13-15* is/are rejected.

7)☒ Claim(s) *6,8,16 and 25* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 November 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date *11302001, 02142002, 06132002*

4)☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Claim Objections

1.   Claim 25 is objected to because it depends on itself.

Claim Rejections - 35 USC § 112

2.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3.   Claim 7 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 7 recites the limitation "the convolution is...". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

4.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102(e) that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5.   Claim 1, 2, 9, 10, and 13 are rejected under 35 U.S.C. 102(e) as being anticipated by Kannan et al (U.S), hereinafter referred to as Kannan.

Re claims 1, 9, and 10, Kannan discloses processing a multi-carrier signal

transmitted across communication channel at Inverse Fast Fourier Transform (IFFT) on

the transmit side (*receiving the multi-carrier signal in time domain*, figure 2, element

260), introducing multi-path delay to a transmitted signal, by receiving the multi-carrier

signal in time domain and transforming the multi-carrier signal from time-domain into

frequency domain (abstract, paragraph [0004], lines 1-5) at FFT on the receive side

(*transforming the multi-carrier signal from time-domain into frequency domain*, figure 2,

element 262) is to convert a received signal into frequency domain. Kannan discloses

determining a communication channel transfer function based on a receipt of a known

pilot or training signal (*estimating channel transfer function using a subset of the multi-

carrier signal in time domain*, paragraph [0050], lines 1-4) and determining a desired

composite communication channel transfer function by a convolution of the equalization

function with the communication channel transfer function (*compensating for the channel

transfer function using the estimated channel transfer function*, paragraph [0112], lines 4-

10).

Re claim 2, Kannan discloses the subset of the multi-carrier signal in time domain

comprises training symbols (paragraph [0038], lines 5-7).

Re claim 13, Kannan discloses communicating data between a transmitter and a

receiver separated by a communication channel (paragraph [0004], lines 1-3, figure 2).

Kannan discloses generating a plurality of sub-carrier signals based on the data,

transforming the plurality of modulated sub-carrier signals into a plurality of time-

domain signals (orthogonal modulator modulates each sub-carrier, paragraph [0032]),

transmitting the plurality of time-domain signals across the channel, processing a multi-

carrier signal transmitted across communication channel at Inverse Fast Fourier

Transform (IFFT) on the transmit side (*receiving the multi-carrier signal in time domain*,

figure 2, element 260), introducing multi-path delay to a transmitted signal, by receiving

the multi-carrier signal in time domain and transforming the multi-carrier signal from

time-domain into frequency domain (abstract, paragraph [0004], lines 1-5) at FFT on the

receive side (*transforming the multi-carrier signal from time-domain into frequency*

domain, figure 2, element 262) is to convert a received signal into frequency domain.

Kannan discloses determining a communication channel transfer function based on a

receipt of a known pilot or training signal (*estimating channel transfer function using a*

subset of the multi-carrier signal in time domain, paragraph [0050], lines 1-4) and

determining a desired composite communication channel transfer function by a

convolution of the equalization function with the communication channel transfer

function (*compensating for the channel transfer function using the estimated channel*

transfer function, paragraph [0112], lines 4-10).

Claim Rejections - 35 USC § 103

6.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7.   Claims 3-5, 7, 14, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Kannan, in view of Thomas et al (US 6826240), hereinafter referred to as Thomas.

        Re claims 3-5, 7, 14, and 15, Kannan discloses all of the limitations of the base

claim, but fails to disclose performing a convolution of the training sequence, processing

a weighing matrix in time domain, and processing of the weighing matrix by performing

a multiplication of the weighing matrix with the convolved training sequence. Thomas

discloses circular convolving of training sequence (column 10, lines 54-58) and

performing a multiplication of the weighing matrix with the convolved training sequence

(column 11, lines 5-8). It would have been obvious for one of ordinary skill in the art to

modify Kannan to perform a multiplication of the weighing matrix with the convolved

training sequence since the good autocorrelation properties of the training sequences make for

easy and accurate synchronization and radio channel estimations.

Allowable Subject Matter

8.   Claims 6, 8, and 16, are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

        Claims 11, 12, 17-24, and 26-30 are allowable.

        The following is an examiner's statement for reasons for allowance.

9.   Claim 6 is allowable over the prior art of record since the cited references taken

individually or in combination fail to particularly teach or fairly suggest the weighing

matrix comprising values that account for the finite time response of the channel and the position of zero sub-carriers in the frequency domain.

Claims 8 and 16 are allowable over the prior art of record since the cited references taken individually or in combination fail to particularly teach or fairly suggest the estimating step for determining an optimum time window within which the multiplication of the weighing matrix occurs.

Claim 11 is allowable over the prior art of record since the cited references taken individually or in combination fail to particularly teach or fairly suggest a channel estimation method by receiving a time-domain multi-carrier signal representing a channel training sequence, performing a cyclic convolution on the training sequence, extracting a time window within which the received signal has optimum amount of energy, and multiplying a weighing matrix with the convolved training sequence to arrive at channel estimates, wherein, the multiplying occurs during the time window extracted by the extracting step.

Claim 17 is allowable over the prior art of record since the cited references taken individually or in combination fail to particularly teach or fairly suggest a receiver, in a multi-carrier data communication system, comprising a channel estimator that receives a multi-carrier time-domain signal at an input and generates a plurality of channel estimates at an output, a time-domain to frequency-domain transform unit coupled to the output of the channel estimator and configured to convert the multi-carrier time-domain signal and the channel estimates from time domain into frequency domain, and an equalizer coupled to an output of the transform unit and configured to compensate the multi-carrier signal for channel effects using the channel estimates.

Claim 26 is allowable over the prior art of record since the cited references taken

individually or in combination fail to particularly teach or fairly suggest a multi-carrier

data communication system comprising a transmitter including a

demodulator/deserializer configured to convert an input data stream into a parallel

plurality of multi-carrier signals, a frequency-domain to time-domain converter having an

input coupled to the modulator/deserializer and configured to transform the parallel

plurality of multi-carrier signals from frequency domain into time domain at an output, a

guard period insertion block coupled to the frequency-domain to time-domain converter

and configured to insert a guard period in the output of the frequency-domain to time-

domain converter, a serializer coupled to an output of the guard period insertion block

and configured to perform a parallel to serial conversion on the signal, and a digital-to-

analog converter coupled to the serializer and configured to convert the digital signal into

an analog signal and to transmit the analog multi-carrier time-domain signal across a

channel, a receiver including an analog-to-digital converter coupled to receive the analog

signal and configured to convert the analog signal into a digital signal, a deserializer

coupled to the analog-to-digital converter and configured to convert the digital signal into

a plurality of parallel signals, a channel estimator coupled to the deserializer and

configured to derive channel estimates using a training sequence embedded into to

received time-domain signal, a guard period removal block coupled to an output of the

channel estimator and configured to remove the guard period, a time-domain to

frequency-domain converter coupled to an output of the guard period removal block, an

equalizer coupled to the time-domain to frequency-domain converter and configured to

equalize the signal using the channel estimates, a serializer/demodulator coupled to an

output of the equalizer and configured to generate an output data stream.

Conclusion

10.   The prior art made of record and not relied upon is considered pertinent to applicant's
disclosure.

- US Patent (5796814) to Brajal et al
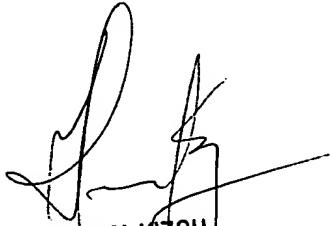
- US Patent (6765969) to Vook et al

11.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Hong Cho whose telephone number is 571-272-3087.

The examiner can normally be reached on Mon-Fri during 7 am to 4 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Hassan Kizou can be reached on 571-272-3088. The fax phone number for

the organization where this application or proceeding is assigned is 571-273-3088.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published

applications may be obtained from either Private PAIR or Public PAIR. Status

information for unpublished applications is available through Private PAIR only. For

more information about the PAIR system, see http://pair-direct.uspto.gov. Should you

have questions on access to the Private PAIR system, contact the Electronic Business

Center (EBC) at 866-217-9197 (toll-free).

Hong Cho
Patent Examiner
9/6/2005

HASSAN KIZOU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600